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Issued February 26, 1918.

PORTO RICO AGRICULTURAL EXPERIMENT STATION,
D. W. MAY, Agronomist in Charge.
MAYAGUEZ, P. R.

Circular No. 16.

REARING QUEEN BEES IN PORTO RICO.

BY

R. H. VAN ZWALUWENBURG,
Entomologist,
AND
RAFAEL VIDAL.

UNDER THE SUPERVISION OF
STATES RELATIONS SERVICE,
Office of Experiment Stations,
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PORTO RICO AGRICULTURAL EXPERIMENT STATION.

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REARING QUEEN BEES IN PORTO RICO.

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INTRODUCTION.

Beekeeping in Porto Rico received its greatest impetus in about 1908. Within the succeeding four years hundreds of beginners entered the business on a small scale, beginning in most cases with nuclei obtained from the experiment station at Mayaguez. Little trouble appeared to arise until about four years later, when complaints of poor crops began to come in. The average colony production has dropped steadily each year since, until now, when the price of honey is the highest ever offered on the island (\$1.20 per gallon), many beekeepers find themselves with practically no crop.

This falling off in production has been assigned to various causes, a few of which have weight, but that these are the primary causes does not seem probable. For instance, rains are often the cause of large losses, as they wash out the nectar-laden blooms. Production during the past season was lower than that of the previous year, in spite of the fact that there were fewer heavy rains at blooming time. Again, many parts of Porto Rico, especially in the western third of the island, are undoubtedly overstocked. Yet, there are cases on record where beekeepers have bought and destroyed all colonies within a radius of 4 kilometers of the home apiary without succeeding in halting the downward trend of production in the home yard.

When it is considered that a great many beekeepers have continued to use their old stock year after year without an effort toward improvement or selection, the real cause of poor honey crops is not hard to determine. Undersized workers tell the story plainly. *Degenerated stock is the principal cause of poor honey production in Porto Rico.*

The remedy for degeneration is the introduction of new stock to be used in careful selective breeding. This may be carried out by the

purchase of a few pure select queens and the artificial rearing of queens from them. It is manifestly bad policy to purchase a queen for every colony in the apiary, as this not only involves too great an expense, but also causes the loss of one of the primary advantages of queen-rearing, namely, the opportunity to select from the best producing colonies. The idea in artificial queen breeding is to get large quantities of queens of known strain at a nominal price. With a large number of good queens on hand selection and improvement can be constantly made.

Beekeepers in the Tropics should requeen their entire apiary once a year. In a hot climate a queen lays throughout the year and naturally becomes exhausted more quickly than one having a winter resting period. It is a well-known fact that a queen lays more eggs during the first year than in any later year, and since maximum honey production is dependent upon maximum brood production, providing a new queen every year tends to keep the production of honey up to the maximum. It is advisable, however, to keep a small number of the best queens, because such queens will always give a good crop during the second year, and because there should be in the apiary queens of known record for later requeening in case of swarming or other emergency.

As pointed out above, it is impracticable to purchase queens for every colony. It is important, therefore, that every beekeeper breed his own queens. Besides the annual requeening, the average beekeeper will need a queen from time to time in case a colony loses its queen through accident. It is better to provide such a colony with a new queen than to let it rear one, for in the former case the colony will gain about three weeks over a colony that has to suspend the collection of stores while it produces a new queen.

One of the most important advantages of rearing queens is that the new queens can be selected from colonies which show high productive ability or some other desirable trait. In this way the standard of the entire apiary can be raised year by year. To do this it is necessary that the beekeeper know absolutely, from record sheets, what the production of each colony is. Tally sheets for bee colonies are of supreme importance in beekeeping, but they are extremely rare in Porto Rico.

It is highly important that the small number of pure, tested queens used to start the work of queen rearing be purchased from an honest and intelligent queen breeder who keeps records of his colonies. If a queen breeder does not keep records of his colonies, his selective breeding is guesswork. *The original queens must be of pure stock or of some fixed cross*, for, as Dr. E. F. Phillips states, when a first cross is used as a breeder the resulting offspring are most

variable. The stock from which the start is made should be of the very best.

The beginner in beekeeping can not expect to rear queens successfully until he has had at least a year's experience. However, any beekeeper with this much experience should, after a little practice, have no trouble if he keeps in mind the biological principles upon which artificial queen rearing is based. In nature, a new queen is produced in a colony in which any of three conditions exist, namely, swarming, supersedure, and queenlessness. To rear queens artificially, one of the three conditions must be followed rather closely. Artificial queen rearing depends on the fact that the larvæ of queens and workers are alike at birth and for about three days after. The ultimate condition of the adult produced depends entirely upon the food given the larvæ, common food producing a worker, royal jelly producing a queen. A worker is a female not fully developed in a certain direction.

The following pages outline the general steps to be followed in artificial queen rearing. Not every emergency that may arise has been foreseen and originality and the ability to meet emergencies are indispensable to the successful beekeeper. This circular is a compilation based largely on the writings of Dr. E. F. Phillips,¹ and is issued to meet the present crisis in Porto Rican beekeeping.

ARTIFICIAL QUEEN REARING.

In Porto Rico the best time to rear queens is usually in the fall months, as then the honey flow is full and usually reliable. Spring and early summer are poor seasons for this work. When rearing queens, it is important to know whether there is a honey flow, as in case there is not, the rearings must be artificially fed.

The colony in which queens are to be reared should be strong and populous and have at least one super. (See fig. 1.) All the unsealed brood frames below should be replaced by sealed ones, so that all the nurse bees can be utilized above in the super where the frame bearing the artificial cells of the embryo queens is to be placed. Of course a queen excluder must be kept between super and hive body. As not all colonies will accept artificial embryo cells, it is best to experiment with two or three colonies until one is found which will accept and bring to maturity at least 70 per cent of the queens.

STARTING QUEEN CELLS.

Natural queen cells can sometimes be used by cutting them from the comb and fastening them with wax to a bar the length of the top

¹ Among these the most use was made of "The Rearing of Queen Bees," U. S. Dept. Agr., Bur. Ent. Bul. 55 (1905).

bar of a frame, the larvæ in such cells being replaced by young larvæ. The several objections to the use of natural queen cells are that they are not uniform and not easily put into nursery cages when sealed; that in most cases they are not easily obtained in sufficient numbers; and that they can not be handled and removed so easily as artificial cells.

CELL CUPS.

For cell cups it is preferable to use an artificial cell base made either of wax or of wood, the type most used having a cylindrical wooden base with a depression in which is placed an artificial wax cell. A flanged base or a nail point allows these cells to be fastened

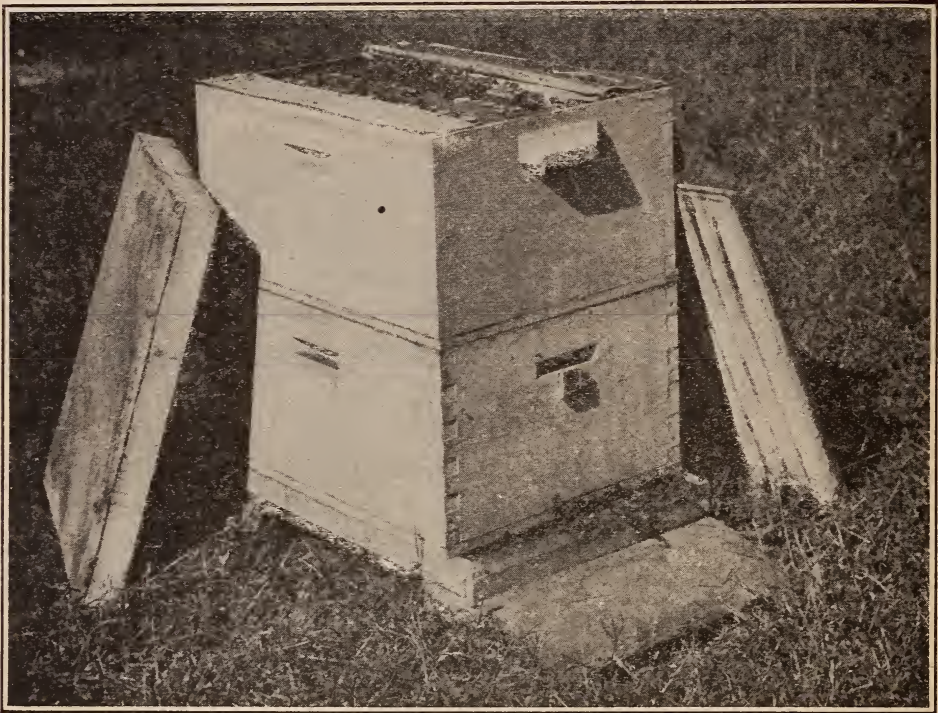


FIG. 1.—Two-story hive with perforated zinc honey board between stories, the top to be used for queen rearing. (After Phillips.)

in a bar fixed to the top bar of an empty frame, in which two or more rows of grafted cells can be put. (See fig. 2.) Such cells, which can be purchased from any dealer in bee supplies, are acceptable to the bees and are easily handled. When used for the first time they should be well smeared with royal jelly to make them more acceptable to the workers. Each cell should be numbered so that careful notes can be kept upon them.

TRANSFERRING LARVÆ.

After the cell bases are in place a small amount of royal jelly which has been well stirred should be transferred to them from an

uncapped queen cell. Then with a toothpick cut thin and bent at the tip to an angle of about 45° , or with a special transferring needle, a larva from the colony whose strain is to be used should be placed in each cell base. Larvæ over 24 hours old should not be used. It is better, in fact, to select those which have been only about 12 hours out of the egg. This work should be done as rapidly and carefully as possible so as to prevent chilling of the larvæ and hardening of the royal jelly. It has been found that the introduction of royal jelly is not essential to success, but its use is considered preferable.

HOW TO START THE CELLS.

The chief difficulty in rearing queens by this method is to get the cells accepted. As a rule, some will not be accepted. The rejections are not greater, however, in case of artificial than in case of natural

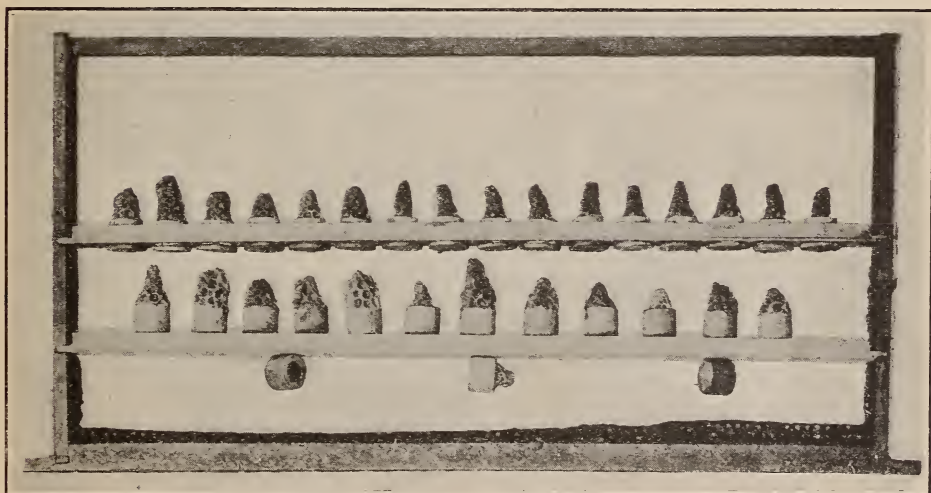


FIG. 2.—Standard frame with bars of queen cells on wooden bases. The upper bar holds cells of the Root pattern. (After Phillips.)

cells. Once started, they are usually completed, even if transferred from one colony to another. Sometimes it is the practice to start cells in a queenless colony and after 24 hours to transfer the bar to a colony with a queen, taking care to protect the cells from the queen by an excluder. (See fig. 3.)

The bar holding the cells should be about 3 inches below the top bar of the frame so that the cells are placed in the middle of the brood chamber where the heat is most uniform. If more than one frame of bars holding cells is placed in a brood chamber, care should be taken not to have too large an open space in the chamber. It will be well to separate the cell frames by a frame of brood.

Italian stock does not accept large numbers of queen cells so readily as do Cyprians or Carniolans, particularly in Porto Rico, possibly because of the high temperature. It may, therefore, be desirable to

maintain a colony or two of Carniolans in the apiary simply as nurse bees for the queens of the more generally desirable Italian strain. In case this is done, care must be taken to use drone traps, or undesirable crosses will occur.

THE SWARM BOX.

The acceptance of artificial queen cells can be facilitated by the use of the swarm box, which takes advantage of the fact that in cramped quarters bees acquire the cell building impulse, and that under this impulse they rear queens in large numbers. A box with a wire screen bottom to provide ventilation is made to hold five frames (see fig. 4), but it is supplied with only three frames, alternating

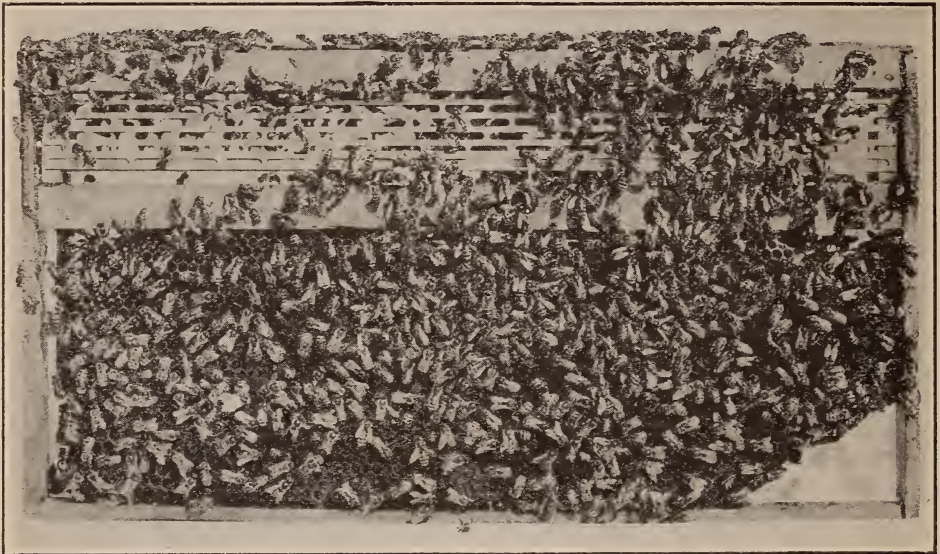


FIG. 3.—“Swarthmore” incubator in frame. The metal supports at the upper ends of the side pieces of the frame do not show. (After Phillips.)

spaces the width of a frame being left. The frames used should be well supplied with stores, one (with empty comb) having water. The top of the box is removable and has two slats corresponding to the spaces between the frames within the box. Into these slats the cell bars fit. The empty cell bars, or plain strips of wood, are placed in the slats, and bees are shaken into the box (without a queen, of course) in sufficient numbers to fill it more completely than is usual in a hive. If this is done in the morning, a majority of nurse bees will be assured, for most of the field bees will be abroad. In about six hours the young larvæ are transferred to artificial bases which are substituted one by one for the slat bars. By the next day the drawing out of artificial cells will have been begun. The bees are then shaken out in front of their old hive and the cells on bars hung in any convenient colony to be completed.

To quote Dr. Phillips¹—

The swarm box has been criticized in various quarters as being opposed to the natural habits of the bees, and it is supposed that this is a valid reason for condemning it. It is a popular fallacy among some beekeepers that there must be absolutely no departure from the natural instincts of the bees, and a new or strange idea is frequently condemned on these false grounds. * * * We must know the habits of the bees; but equally important in practical work is a knowledge of the amount of flexibility in the instinct. In fact, modern apiculture has come to be a study of the modification of conditions under which bees can thrive to bring about the best results for the beekeeper.

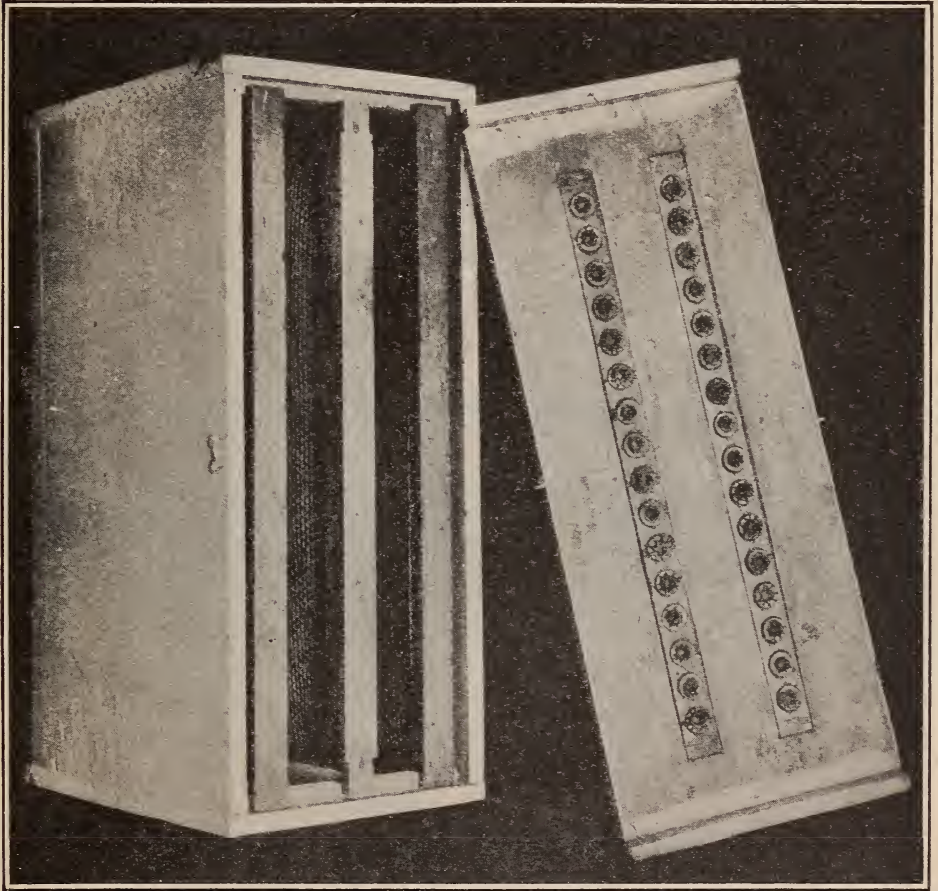


FIG. 4.—Swarm box, showing position of frames and inner side of lid, with wooden cells in place, ready for bees. (After Phillips.)

COMPLETING QUEEN CELLS.

Once queen cells are started their completion is comparatively easy, as they may be hung in a queenless colony without any covering or protection, or in a normal colony if protected by a queen excluder. (See fig. 3, p. 8.) A day before the queens are due to emerge (this period is six days after capping) each cell should be placed in a nur-

¹ Loc. cit., p. 18.

sery cage of wire cloth. (See fig. 5.) The cell should not be caged more than one day before emergence is due, as the queen may be unable to make her exit from the cell if the workers have not thinned down the cell wall sufficiently. Various styles of nursery cages are on the market. A good nursery should have the following points: It "should be so constructed that the queen will be separated from the workers by a wire cloth; should be of such form that any style of artificial queen cell may be placed in it; should contain a place for candy as food for the young queen; and should above all be useful as an introducing cage."¹

It does the young queen no harm to keep her in a nursery until 3 to 5 days old, and from the standpoint of honey production it is preferable to do so. If a queen cell is put in a mating colony, the colony is unproductive for a day or two before emergence of the queen and for at least five days before she mates. Such a method of introduction is hardly profitable.

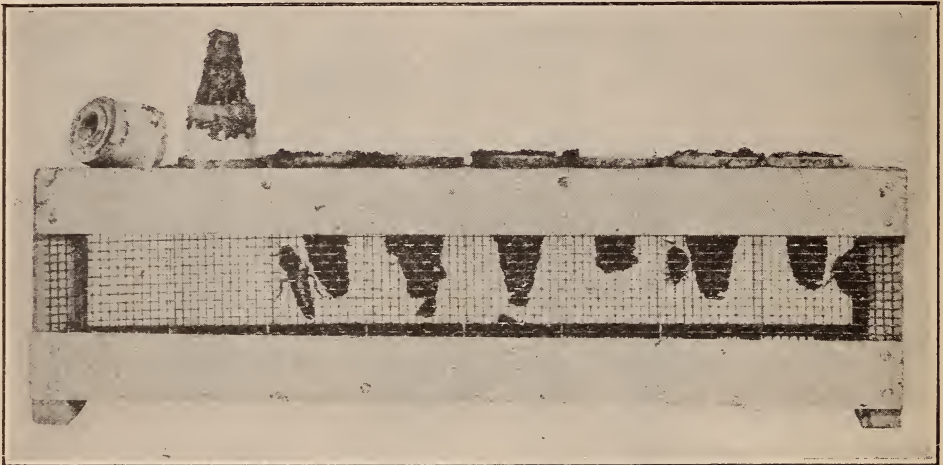


FIG. 5.—"Swarthmore" nursery, with queens. Two cells removed to show construction. (After Phillips.)

MATING QUEENS AND SELECTION OF DRONES.

Referring to the mating of queens and the selection of drones, we can not do better than to quote Dr. Phillips, who says:²

No one can deny that queens may be mated in hives smaller than a full colony, but a question sometimes arises as to whether the queens are as vigorous and prolific after being mated from small boxes. To this it may be answered that the successful mating of a queen depends on the drones which fly in the air; and this is in no way influenced by the size of the hive. It takes very few workers to feed a queen (witness the mailing boxes), and this is the only function of the accompanying bees. If, then, a queen is herself strong and vigorous, and meets an equally vigorous drone, she will be suc-

¹ Loc. cit., p. 23.

² Loc. cit., pp. 27, 29.

cessfully mated, will be just as prolific, and will lay just as long, when kept in a small colony to mate as in a full-sized one. From a practical standpoint it may be answered that queens mated in small nuclei when put to the test have actually proven as good as those mated under other circumstances. This is after all the true test to be used.

The selection of drones is one of the things in which the vast majority of beekeepers are notoriously careless. Queen breeders will select a breeding queen, with great care and allow her progeny to mate with drones from any hive in the apiary, and just as long as this is done there can be no advance in the types. Drones should not be allowed to fly except from colonies where the queens are prolific and the bees good workers, and just as much care should be exercised in the choice of colonies for the production of drones as for breeding queens. * * * Selection of drones may be accomplished by the use of drone traps or by cutting out drone comb. For absolute safety the drone trap is preferable, since some drone brood may escape observation.

TESTING QUEENS.

A beekeeper who is rearing queens for his own use may introduce them into colonies as soon as they begin to lay. A fair idea of a queen's value can be had from the number and regularity of the eggs laid in the nucleus box. If she is later found to be mismated or not up to standard in egg laying, she should be discarded.

An "untested" queen is one which is sold as soon as she begins laying after mating; a "tested" queen is one which is kept under observation until her progeny show the markings of pure mating. Tested queens which show the ability after one season to produce strong colonies are "select tested." For breeding, nothing but the very best select tested queens should be used.

Besides honey production, the qualities which a queen breeder should work for are purity of strain, prolificness, good disposition among the workers, and the tendency to keep a very large colony at all seasons of the year. A colony with the last quality will be better fitted to begin work after the winter dwindling resulting from the nectarless dry season.

SUMMARY.

(1) The decline in honey production in Porto Rico is due to degenerate stock.

(2) This fault can be remedied only by the introduction of fresh stock to be used as a basis for improving the standard of the apiary by constant and intelligent selective queen-breeding.

(3) The steps to be taken in queen rearing are: (a) Transfer to artificial cell cups larvæ between 12 and 24 hours old, using larvæ of a known and desirable strain; (b) inclose accepted cells in a nursery cage 5 days after capping, and keep young queens in nursery cages until 3 to 5 days old.

(4) The chances of artificial queen cells being accepted can be increased by the use of a swarm box.

(5) Bred queens may be mated in either full-sized colonies or in those of reduced size. Successful mating depends on the drones which fly in the air.

(6) Mating with undesirable drones may be prevented by the use of drone traps.

(7) A fair idea of a queen's value can be had from the number and regularity of eggs laid in the nucleus frames. Subsequent observations of her progeny must decide whether she was purely mated.



